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put forth by the celebrated Swiss mathematician EULER, and we are only now beginning to return to them after the lapse of more than a century and a half. The results here briefly outlined appear to be proved beyond doubt, and they afford us an impressive illustration of how cautious we must be in adopting theories merely because they have been handed down by tradition. They also afford us a good idea of how much yet remains to be done in all the physical sciences. With the new methods now introduced, doubt and uncertainty may be very largely replaced by confidence and certainty in all matters relating to cosmical evolution. Henceforth the laws of cosmical evolution will be capable of definite and exact investigations, and cosmogony will become a true physical science.

U. S. NAVAL OBSERVATORY,
MARE ISLAND, CALIFORNIA, June 11, 1909.

PLANETARY PHENOMENA FOR SEPTEMBER AND OCTOBER, 1909.

BY MALCOLM MCNEILL.

PHASES OF THE MOON, PACIFIC TIME.

Last Quarter..	Sept. 6,	11h 44m A.M.		Last Quarter..	Oct. 5,	10h 44m P.M.
New Moon...	" 14,	7 9 A.M.		New Moon...	" 14,	12 13 A.M.
First Quarter..	" 22,	10 31 A.M.		First Quarter..	" 21,	11 4 P.M.
Full Moon....	" 29,	5 5 A.M.		Full Moon....	" 28,	2 7 P.M.

The autumnal equinox, the time when the Sun crosses the equator from north to south, occurs September 23d, 9 A. M., Pacific time.

Mercury is an evening star until October 12th. It then passes inferior conjunction, becoming a morning star, and will continue as morning star until December 2d. It reaches greatest east elongation on the morning of September 17th. Its distance from the Sun is then 26° 34′, but it is so much farther south than the Sun that it will remain above the horizon not quite an hour after sunset. This interval is about the same throughout the first half of September. It is hardly long enough to permit naked eye observations except in unusually clear weather. After passing conjunction and becoming a morning star it moves rapidly out toward greatest west elongation, reaching that position on the night of October 27th-28th. The elongation is only 18° 33′, much less than the average, but the planet is considerably north of the Sun and will rise about an hour and a half before sunrise. This condition lasts only a few days, but it affords a good opportunity for seeing the planet.

Venus is an evening star, setting one hour and twenty minutes after sunset on September 1st, and the interval increases about an hour before October 31st. The planet's motion among the stars is 72° eastward and 22° southward from *Virgo* through *Libra* and *Scorpio*, passing about 1° north of *Spica*, *α Virginis* on September 9th, and 3° north of *Antares*, *α Scorpii*, on October 19th.

Mars will be in better position for observation than it has been at any time since the opposition of August, 1892. On September 1st it rises about an hour and a half after sunset; on September 24th, 2 A. M., Pacific time, it reaches opposition, then being above the horizon the entire night; and on October 31st it does not set until nearly 3 A. M. Its motion is retrograde up to October 26th, and amounts to about 11° westward with a small motion southward and then northward; on the whole a little north of its path of eastward motion during July and August. It is in the constellation *Pisces*, and passes about 4° south of the vernal equinoctial point on October 3d. On September 1st it is occulted by the Moon, and the phenomenon may be seen throughout the greater part of the United States, but the times, like those of an eclipse of the Sun, vary very much. At Washington the occultation lasts from $8^h 42^m$ to $9^h 39^m$ P. M. The planet's distance from the Earth in millions of miles is 38.1 on September 1st, 36.1 on September 17th, the minimum coming about a week before opposition, 37.5 on October 1st, and about 49 on October 31st. Its brightness does not vary greatly during September, but begins to diminish rapidly in October, so that by the end of the month it will have lost about 50 per cent. The planet's distance from the Earth will be less by about 2,000,000 miles than it was at the last opposition, July, 1907, and, in addition, the planet's position is more than 20° north of its position in 1907 and in consequence its meridian altitude is greater by the same amount. This means a vastly better position for observation, at least for observatories in the northern hemisphere. As compared with conditions in 1892, the minimum distance is about 1,000,000 miles greater, but in 1892 the planet was far south of its 1909 position, and its meridian altitude was about 15° less. The synodic period, the interval from opposition to opposition, varies nearly fifty days; the interval between the 1909 and 1907 oppositions will be 801 days, while between the oppositions of 1899 and 1901 it was only 764 days.

Jupiter passes conjunction with the Sun and changes from an evening to a morning star on September 18th. During the greater part of the month it is too near the Sun to be seen. By October 1st it rises nearly an hour before sunrise, and this interval increases nearly two hours during the month.

Saturn rises at about 8:30 P. M. on September 1st, comes to opposition on October 13th, and remains above the horizon until nearly 5 A. M. on October 31st. It retrogrades about 4° during September and October. On September 1st it is about 15° east of *Mars*. This distance increases about 4° during the month owing to the greater westward motion of *Mars*, but will begin to diminish in October.

Uranus is above the horizon until after 1 A. M. on September 1st and until after 9 P. M. on October 31st. It moves slowly westward until September 26th and then moves eastward, the whole motion being less than 1°. It remains in *Sagittarius* east and north of the milk dipper, with no bright stars near.

Neptune is in *Gemini*, rising after 1 A. M. on September 1st and at about 9:30 P. M. on October 31st.